1. Problem P6, Chapter 1

   (a) $d_{prop} = \frac{m}{s}$ $[s]$

   (b) $d_{trans} = \frac{L}{R}$ $[s]$

   (c) $d_{end-to-end} = d_{prop} + d_{trans} = \frac{m}{s} + \frac{L}{R}$ $[s]$

   (d) After $t = d_{trans}$, the last bit of the packet will have just left Host A into the link.

   (e) $d_{prop} > d_{trans}$ $\rightarrow$ The delay for bits to propagate through the medium is greater than the delay of the packets being pushed into the medium. The first bit will not arrive at Host B before the next packets starts into the medium causing a bottleneck in the medium near Host B.

   (f) $d_{prop} < d_{trans}$ $\rightarrow$ This time, a bottleneck will occur at Host A as the bits have finished traveling through the medium while Host A is stilling getting the next bit ready.

   (g) $s = 2.5 \times 10^8 \ \frac{m}{s} \qquad L = 120 \ bits \qquad R = 56 \times 10^3 \ \frac{bits}{s}$

   $$d_{prop} = d_{trans} \quad \rightarrow \quad \frac{m}{s} = \frac{L}{R} \quad \rightarrow \quad m = \frac{L \times s}{R} = \frac{120 \ bits \times 2.5 \times 10^8 \ \frac{m}{s}}{56 \times 10^3 \ \frac{bits}{s}}$$

   $$= 535.71 \ km$$

2. Problem P7, Chapter 1

   $$R = 2 \times 10^6 \ \frac{bits}{s} \qquad L = 56 \ bytes = 448 \ bits \qquad d_{prop} = 10 \ ms$$

   $$d_{ADC} = \frac{448 \ bits}{64 \times 10^3 \ \frac{bits}{s}} = 7 \ ms \qquad d_{trans} = \frac{L}{R} = \frac{448 \ bits}{2 \times 10^6 \ \frac{bits}{s}} = 0.224 \ ms$$

   $$d_{end-to-end} = d_{ADC} + d_{trans} + d_{prop} = 7 \ ms + 0.224 \ ms + 10 \ ms = 17.224 \ ms$$

3. Problem P29, Chapter 1

   $$R = 10 \times 10^6 \ \frac{bits}{s} \qquad s = 2.4 \times 10^8 \ \frac{m}{s} \qquad l = 35793 \ km$$

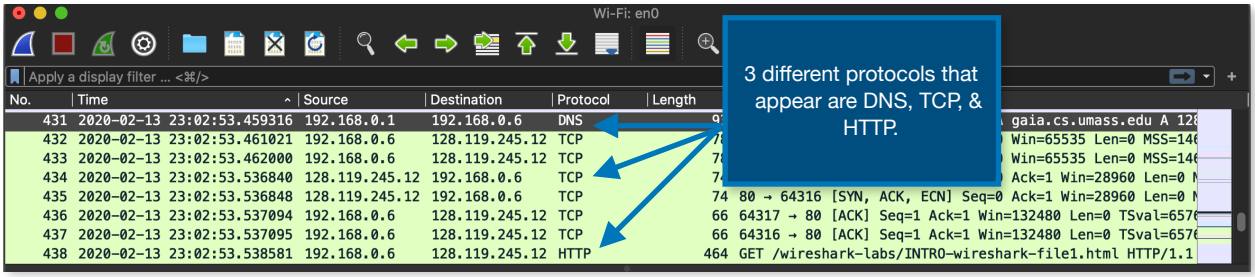
   (a) $d_{prop} = \frac{l}{s} = \frac{35793 \ km}{2.4 \times 10^8 \ \frac{m}{s}} = 149.14 \ ms$

   (b) $d_{BW} = R \times d_{prop} = \frac{10 \times 10^6 \ \frac{bits}{s}}{149.14 \ ms} = 1.4914 \ Mbits$

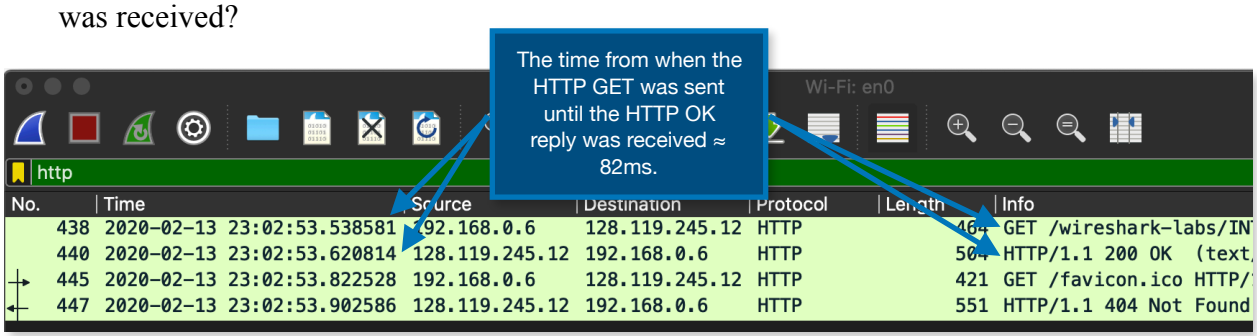
   (c) $x = photo \ size \ [bits] = 10 \times 10^6 \ \frac{bits}{s} \times 60 \ s = 600 \ Mbits$

4. Wireshark Lab #1

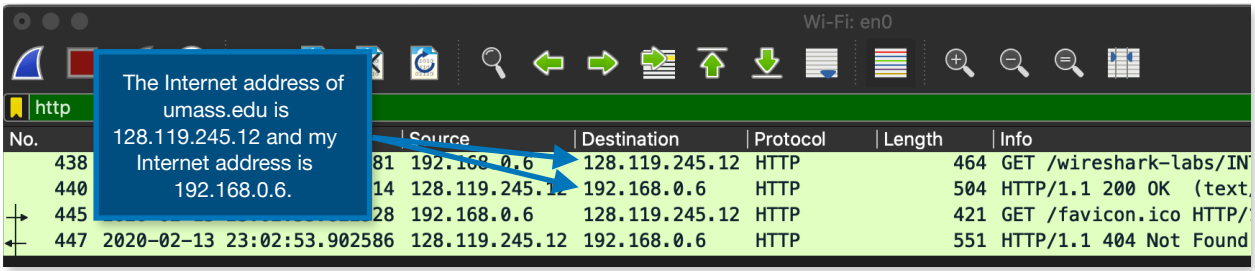
(1) List 3 different protocols that appear in the protocol column in the unfiltered packet-listing window in step 7 above.



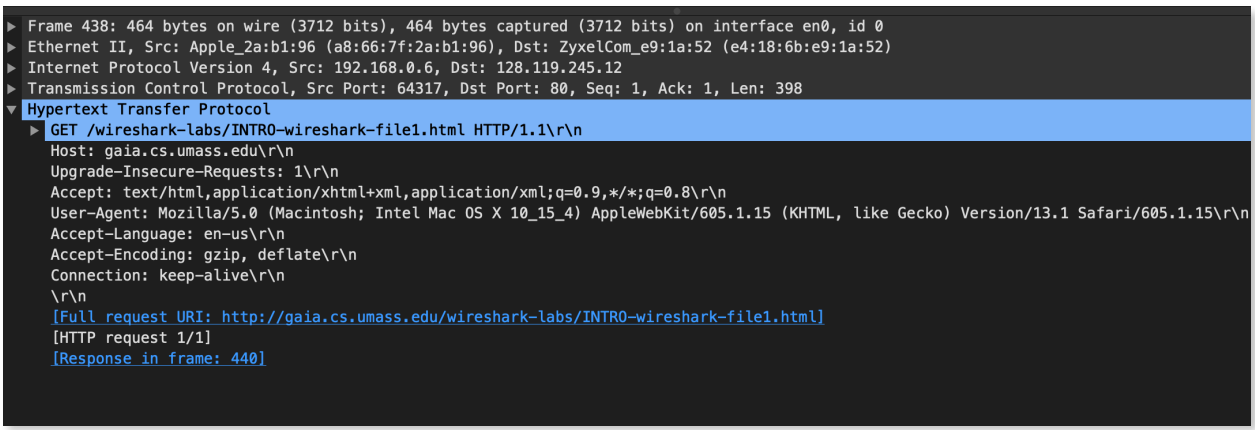
(2) How long did it take from when the HTTP GET message was sent until the HTTP OK reply was received?

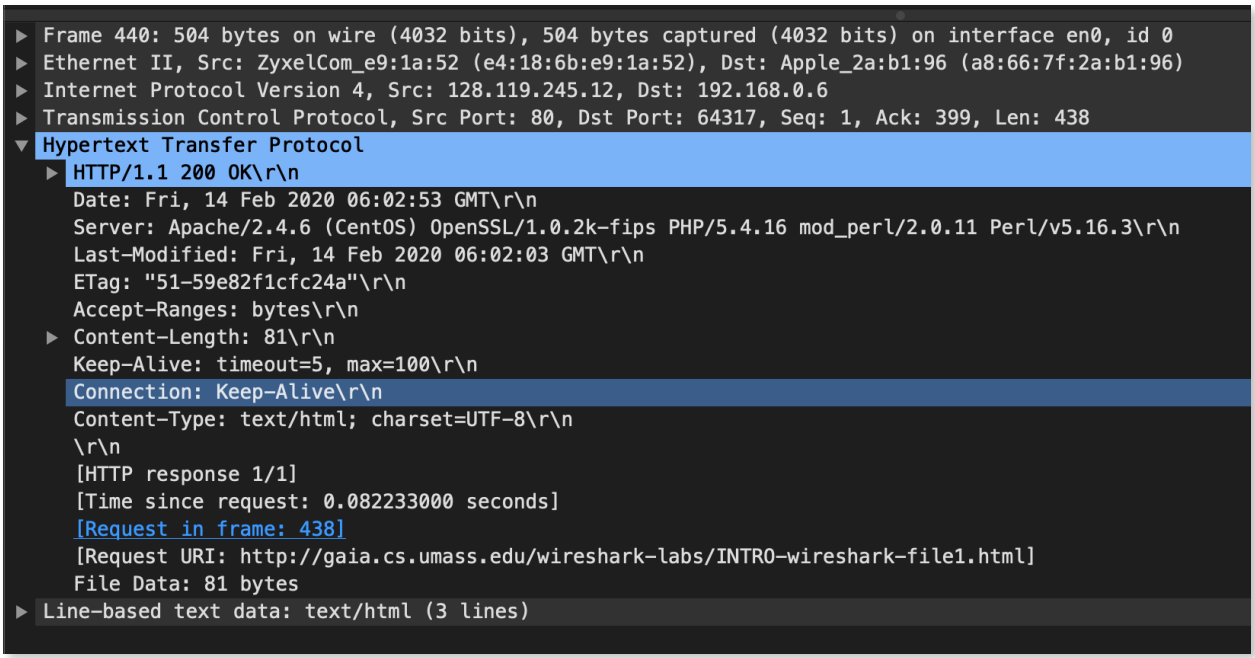


(3) What is the Internet address of the gaia.cs.umass.edu (also known as wwwnet.cs.umass.edu)? What is the Internet address of your computer?



(4) Print the two HTTP messages (GET and OK) referred to in question 2 above.




▶ Frame 440: 504 bytes on wire (4032 bits), 504 bytes captured (4032 bits) on interface en0, id 0
▶ Ethernet II, Src: ZyxelCom_e9:1a:52 (e4:18:6b:e9:1a:52), Dst: Apple_2a:b1:96 (a8:66:7f:2a:b1:96)
▶ Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.0.6
▶ Transmission Control Protocol, Src Port: 80, Dst Port: 64317, Seq: 1, Ack: 399, Len: 438
▼ Hypertext Transfer Protocol
▶ HTTP/1.1 200 OK\r\n
Date: Fri, 14 Feb 2020 06:02:53 GMT\r\n
Server: Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/5.4.16 mod_perl/2.0.11 Perl/v5.16.3\r\n
Last-Modified: Fri, 14 Feb 2020 06:02:03 GMT\r\n
ETag: "51-59e82f1cfc24a"\r\n
Accept-Ranges: bytes\r\n
▶ Content-Length: 81\r\n
Keep-Alive: timeout=5, max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=UTF-8\r\n
\r\n
[HTTP response 1/1]
[Time since request: 0.082233000 seconds]
[Request in frame: 438]
[Request URI: http://gaia.cs.umass.edu/wireshark-labs/INTRO-wireshark-file1.html]
File Data: 81 bytes
▶ Line-based text data: text/html (3 lines)